

Appl. No. 10/707,997
Response to Office Action dated December 15, 2005

REMARKS

The specification and Claim 39 are amended; claims 1-39 are pending in the application. Claims 1 and 7-10 stand rejected as obvious in view of *Dean*; claims 2-6 and 11-39 stand rejected as obvious in view of *Dean* in combination with either *Johnson* or *Herbst*. Further examination of the application as amended and reconsideration of the rejections are respectfully requested.

The amendment to claim 39 recites a lower normal boiling point limit for the solvent of 32°C (90°F), a solvent to feed ratio from 2:1 to 10:1, and a reactor P/T of 4.8-13.8 MPa/454°-538°C (850°-1000°F), support for which is found in original claims 2, 22, 30 and specification paragraph 0041, inter alia, and presents no new matter.

The amendment to paragraph 0074 of the specification corrects the readily apparent typographical error of referring to Figs. 9-11 intended to refer to Figs. 8-10, and likewise presents no new matter.

The prior art rejection of claims 1-39 in the first office action was withdrawn, and new grounds of rejection applied in the latest office action under sections 102 and 103 in view of the same references: *Dean*, *Johnson* and *Herbst*. The new rejections are respectfully traversed in that they appear to be premised on an erroneous reading of the operating pressure in *Dean*

“of from 1 to 100 atm” in the office action at page 4; however, *Dean* actually teaches (at 9/23-25) “employing a reactor pressure from about atmospheric pressure up to about 100 psig but generally not above about 50 psig” (emphasis supplied):

Dean 9/17-25

Depending on the feed hydrocarbon to be converted, its boiling range and Conradson carbon contributing factor, the hydrocarbon conversion operation may be effected at a temperature in the range of 950.degree. F. up to about 1400.degree. F. or at a temperature equal to or above the feed pseudo-critical temperature employing a reactor pressure from about atmospheric pressure up to about 100 psig but generally not above about 50 psig.

The 100 psig upper limit taught in *Dean* is 114.7 psia, or about 7.8 atmospheres, or a mere 0.79 MPa. This is well below the critical pressure of 1:2 hydrocarbon-solvent systems with hydrocarbons normally boiling over 538°C (1000°F), e.g. clearly more than 7 MPa (69 atmospheres or 1000 psig) for the 2:1 solvent-feedstock systems of ATB-n-heptane, ATB-toluene and VTB-toluene systems shown in Figs. 8-11 of the specification. Applicant’s supercritical pressure operation is a full order of magnitude greater than the 100 PSIG upper limit taught in *Dean*. *Dean* can hardly be said to have taught or suggested applicant’s claimed reaction pressure, and indeed teaches squarely away in that the reaction pressure will generally not exceed 50 psig (64.7 psia = 0.45 MPa = 4.4 atm).

Moreover, the operating pressure of the reactor above the solvent-feed mixture critical pressure is clearly critical to the invention. Claim 1 affirmatively recites that the reaction zone is maintained above the critical pressure of the feed mixture, i.e. the P_c of the mixture of high-boiling feed hydrocarbons and solvating hydrocarbons, rather than just the P_c of the solvating hydrocarbons alone or the feed alone. See paragraph 0041. The critical pressure of a hydrocarbon mixture is higher than that of the individual hydrocarbon components. See paragraph 0074 and Figs. 8 – 11 for several feedstock-solvent systems.

Dean, in contrast, operates under sub-critical conditions where vaporization of the feed occurs and the partial pressure is *reduced* to facilitate vaporization. Nowhere does *Dean* provide any other teaching, suggestion or guidance as to the pressure to be employed in the FCC processing other than the 1-100 psig range, and the generally not more than 50 psig. *Dean* has an operating pressure that is an order of magnitude less than in applicant's invention which has an operating pressure at 4.8 to 13.8 MPa (715-2015 psi, 48.7-137 atm) as noted in paragraph 0041. *Dean* fails to teach or suggest, explicitly or implicitly, that it would have even been obvious to try a supercritical pressure in the reaction zone, let alone the results of applicant that complete or nearly complete conversion can be

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obtained under supercritical pressure, non-catalytic conditions with high solvent dilution rates. Indeed, the high cost of structural and mechanical requirements for high temperature high pressure reaction vessels and piping, relative to their low pressure counterparts, generally motivates the skilled artisan to use the lowest design pressure possible unless there is an overwhelming need or advantage that would justify the significant additional expense of high pressure operations. There is simply no motivation in *Dean* to override the clear disincentives for operation at the pressures claimed by applicant herein, and the office action provides none.

Other arguments advanced in response to the previous office action are fully applicable given that the same references are cited by the examiner, and will be incorporated by reference in lieu of repetition. By way of summary, *Dean* fails to teach or suggest (1) the use of solvating hydrocarbons, (2) a weight ratio of solvating hydrocarbons to feed hydrocarbons of at least 2:1, (3) operation of the reactor at a temperature above the critical temperature *of the feed/solvent mixture*, and (4) operation of the reactor at a pressure above the critical pressure *of the feed/solvent mixture*.

Primarily, *Dean* is a catalytic process and intends to catalytically crack the +600 °F hydrocarbons into liquid hydrocarbons without solvents,

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without employing a high solvent dilution rate, without ensuring supercritical temperature operation, and as noted above without ensuring supercritical pressure operation. Even if arguing *Dean* were to suggest any one of these four critical parameters individually by happenstance, it still would not have suggested their mutual selection other than by way of impermissible hindsight reconstruction using applicant's own disclosure as a roadmap to selectively pick and choose the critical combination of features.

As to solvents with the +1000 °F feed material in a minimum weight ratio of 2:1, the office action asserts *Dean* for (1) atomization with C3 gaseous hydrocarbons, and possibly by implication (2) 600 °F to 1000 °F gas oils in the feed material. However, atomization is relevant only in the context of low subcritical pressure operations, and does not teach or suggest solvation at the relatively high rate of dilution critical to applicant's invention. Even the relatively minor amounts of gas oils that may be present in typical ATB/VTB or other bituminous feed materials would not have taught or suggested the use of gas oils as solvents at the solvent diluent rate required in applicant's claimed invention. Moreover, claims 2-6, 24-27 and 39 would exclude C3 atomization gases from the solvent:feedstock weight ratio calculations, and claim 22 further recites a specific range of solvent dilution. The ratio of solvent to feedstock is critical because, if the ratio of

solvent to feed is too low, the supercritical temperature/pressure of the mixture are too high and/or thermal conversion is too low with excessive coke make with reactor fouling or plugging. See the specification at paragraph 0047.

Dean is an FCC process not at all similar to the present supercritical solution conversion process of the present invention, which is patentably distinct from *Dean*. FCC processes are contrasted by applicant in the specification at paragraph 0013. It is respectfully requested that *Dean* be withdrawn as a section 103 reference.

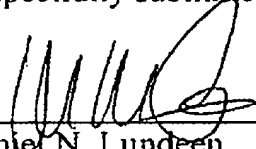
Johnson and *Herbst* are cited as secondary references against claims 2-6 and 11-39. Since they are similarly directed to FCC processes, however, they similarly fail to fill the gap from the conventional FCC process of *Dean* to applicant's claimed invention. Neither reference teaches or suggests converting a high-boiling hydrocarbon with a hydrocarbon solvent at a solvent to feed ratio of at least 2:1 and at supercritical temperature and pressure of the feed-solvent mixture, nor the recovery and recycle of generally inert solvent from the reactor effluent. Note that *Herbst* and *Johnson* recycle heavy materials as reactants to the risers, and do not teach or suggest recycling any solvents that would be generally inert in the reactor which can generally obtain complete or nearly complete conversion of the

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feed. Applicant's invention can obviate unconverted reactant recycle by providing complete or nearly complete feedstock conversion.

It is respectfully submitted that the present application is in condition for allowance. Should any issues remain that are appropriate to telephone resolution, please contact undersigned counsel.

Respectfully submitted,



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